

MICROIRRIGATION SYSTEM EVALUATION VERSION 1.1 USERS GUIDE

Workbook Documentation

MICRO IRR EVAL is a Microsoft Excel® workbook developed using Microsoft Visual Basic for Applications® to evaluate a microirrigation system. The workbook is based upon the evaluation procedure located in the National Irrigation Guide and Part 623 National Engineering Handbook, Chapter 7, Trickle Irrigation. This workbook has been developed to comply with the Natural Resources Conservation Service (NRCS) conservation practice standard Irrigation System, Microirrigation Code 441.

Workbook Purpose and Description

This workbook was developed to aid in the field evaluation of microirrigation systems (drip, spray and line source emitter). The workbook serves as means to document system data and will calculate the average emission rate and system emission uniformity. The workbook provides a detailed report of the evaluation.

Software Requirements

Use of this workbook requires that Microsoft Excel® be installed. This workbook works best with Microsoft Excel® 97 or later. The user should have a basic understanding of Excel®.

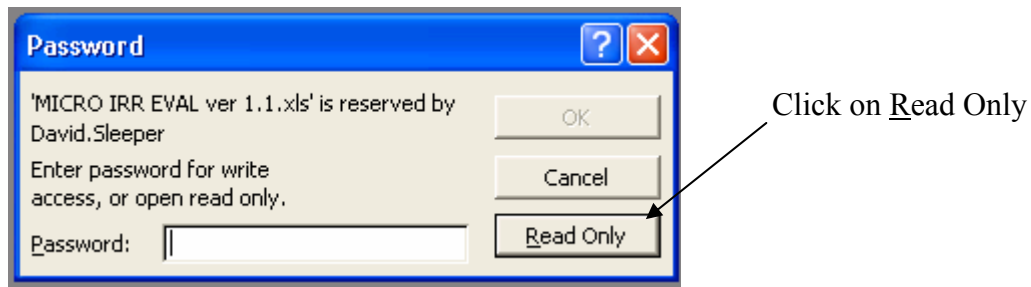
Installing the Workbook

Place the MICRO IRR EVAL workbook in the appropriate directory. Open the workbook by double clicking on the file or through the Excel program. Upon opening the workbook, a dialog box will appear. The “enable macros” button must be clicked in order to use this workbook accurately.



Click on Enable Macros

Another dialog box will then appear; the user then selects the “read-only” button. This option allows user inputs, however, it prevents the overwriting of the original file by requiring the user to save the file as a different name. The workbook is password protected. The user may modify any value in the yellow cells. Since this workbook is protected, only the values in the yellow cells may be modified.



References

NRCS National Engineering Handbook, Part 623, Chapter 7, Pages 7-101 to 7-108

Disclaimer Statement

The USDA NRCS cannot assume liability for the use or maintenance of this workbook or any results it may produce.

Output

The user has the option of printing each of three main output pages as well as extra report pages with site-specific recommendations. The user has the option of printing all recommendations as well as selecting which of the recommendations are printed. These recommendations are printed into a text box within the workbook. The user also has the option to add any other recommendations that may not be in the list, by clicking inside the textbox and then typing. In addition, the program will print out a microirrigation evaluation form as well as an equipment list performing the evaluation.

Note: Excel is a copyright of Microsoft Corporation. Screen shots reprinted by permission from Microsoft Corporation.

EXAMPLE OUTPUT

The following is a sample for the spray type of microirrigation system.

Sheet: "EvalPage1"

PUT YOUR ADDRESS HERE
YOUR STREET
YOUR CITY, STATE ZIP
(xxx) xxx-xxxx

MICROIRRIGATION EVALUATION Ver 1.1**IDENTIFICATION**

Farmer/Operator:	Your Name	Technicians:	Your Name
Address:	123 Your Street	Date:	08/26/03
	Anywhere, FL xxxxx	Evaluation Date:	08/26/03
Phone:	(xxx) xxx-xxxx	Field Office:	Your Office
County:	Your	Field ID:	North
Field Area (acres):	25.0	Field No:	1
Filename:	S:\Service_Center\NRCS\ENGL - Software\Example-08-26-03.mic		

SYSTEM INVENTORY

SYSTEM			
Type (Drip, Spray or Line Source):	Spray	Age (years):	15
EMITTER			
Type:	12 Stream	Make:	Company
Model:	Super	Pressure Compensating (Y or N):	N
Design Pressure (psi):	20	Design Discharge (gph):	16
Number of Emitters per plant:	1	Spacing (ft):	12.5
		Discharge Exponent (Blank=unk.):	
SYSTEM DATA			
Pump rpm	1800	Capacity (gpm):	400
Flow Meter? (Y or N):	N	Number of Zones:	1
LATERAL (TUBING)			
Number of laterals/row:	1	Length (ft):	315
		Inside Diameter (in):	0.75
CHEMIGATION			
Fertilizer? (Y or N)	N	Chlorine or Acid? (Y or N):	N
FILTERS			
Sand Media? (Y or N)	N	Screen? (Y or N):	Y
Centrifugal Separator? (Y or N):	N	Automatic flushing? (Y or N):	N
PRESSURE REGULATED			
Automatic at head? (Y or N):	N	Manual Throttle at Head? (Y or N):	Y
At entrance to manifolds? (Y or N):	N	At Entrance to Laterals? (Y or N):	N
CROP			
Type:	Citrus	Transpiration Ratio (1 to 1.1):	1.1
Row spacing (ft):	25	Plant Spacing (ft):	12.5
Canopy Dimensions (ft):	Diameter	Age (years)	12
	Length	(months)	
	Width	Root Depth (in):	24
Peak Water Requirement (in/day):	0.19	Annual Irrigation Required (in/yr):	13
SOIL			
Series:	Candler	Texture:	SAND
Water Holding Capacity (in/in):	0.055		
IRRIGATION OPERATION			
Peak Irrigation Duration (hrs):	6	Frequency (whole days):	3
MAD (Management Allowed Deficit) (%):	50		
WATER SOURCE -(well or surface):		PUMP TYPE:	Turbine-Diesel

Sheet: "EvalPage2"

PUT YOUR ADDRESS HERE
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(xxx) xxx-xxxx

MICROIRRIGATION EVALUATION Ver 1.1**FIELD TEST DATA**

Name:	Your Name		
Date:	08/26/03		
Field ID:	North		
Zone Number:	1	Manifold Number:	1
		Acres in Zone:	25

TEST MANIFOLD FIELD DATA

		Row #	1	2		3		4		
Plant #	Outlet Location on Lateral	Lateral location on the manifold								
		Inlet End		1/3 down		2/3 down		Far End		
		ml	gph	ml	gph	ml	gph	ml	gph	
1		A	550	17.44	510	16.17	500	15.85	480	15.22
		B		0.00		0.00		0.00		0.00
		Ave	550	17.44	510	16.17	500	15.85	480	15.22
		Pressure	22	psi	20	psi	20	psi	18	psi
2		A	550	17.44	500	15.85	500	15.85	460	14.58
		B		0.00		0.00		0.00		0.00
		Ave	550	17.44	500	15.85	500	15.85	460	14.58
	Pressure		psi		psi		psi		psi	
3	A	510	16.17	480	15.22	470	14.90	450	14.27	
	B		0.00		0.00		0.00		0.00	
	Ave	510	16.17	480	15.22	470	14.90	450	14.27	
	Pressure		psi		psi		psi		psi	
4	A	490	15.53	470	14.90	350	11.10	350	11.10	
	B		0.00		0.00		0.00		0.00	
	Ave	490	15.53	470	14.90	350	11.10	350	11.10	
	Pressure	19	psi	18	psi	18	psi	16	psi	

Wet area
per plant

	Inlet End	1/3 down	2/3 down	Far End
Diameter	13.0 ft	13.0 ft	13.0 ft	13.0 ft
Angle	360 degrees	360 degrees	360 degrees	360 degrees
Length	ft	ft	ft	ft
Width	ft	ft	ft	ft

Wetted Area per Plant
Wetted % of Field

132.7 sq ft	132.7 sq ft	132.7 sq ft	132.7 sq ft
42.5 %	42.5 %	42.5 %	42.5 %

Discharge test collection time (sec):	30	Test length, line source only (ft):	
Present Irrigation -duration (hr):	3	-interval (days):	3
Filter Pressure -inlet (psi):	25	-outlet (psi):	20

MINIMUM LATERAL INLET PRESSURE (MLIP) ON OPERATING MANIFOLDS

Manifold:	1	2	3	4	5	6	7	8	9
Pressure (psi):	20	18	16	14					
Manifold:	10	11	12	13	14	15	16	17	18
Pressure (psi):									
Manifold:	19	20	21	22	23	24	25	26	27
Pressure (psi):									

The average MLIP is **17.0 psi**

Sheet: "EvalPage3"

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(xxx) xxx-xxxx

MICROIRRIGATION EVALUATION Ver 1.1

Farmer/Operator:	<u>Your Name</u>	Technicians:	<u>Your Name</u>
Address:	<u>123 Your Street</u>	Date:	<u>08/26/03</u>
	<u>Anywhere, FL xxxxx</u>	Evaluation Date:	<u>08/26/03</u>
Phone:	<u>(xxx) xxx-xxxx</u>	Field Office:	<u>Your Office</u>
County:	<u>Your</u>	Field ID:	<u>North</u>
Field Area (acres):	<u>25</u>	Field No:	<u>1</u>

EVALUATION SUMMARY**TEST MANIFOLD**

Minimum lateral inlet pressure:	18.0 psi	
Minimum emitter discharge rate:	11.10 gph	-27% Variation from ave. emitter disch. rate
Maximum emitter discharge rate:	17.44 gph	15% Variation from ave. emitter disch. rate
Average test manifold emitter discharge rate:	15.10 gph	
Test manifold emission uniformity:	85 %	

SYSTEM

Minimum pressure at manifolds:	14.0 psi
Maximum pressure at manifolds:	20.0 psi
Adjusted system emitter discharge rate:	14.58 gph
System emission uniformity:	76 %

These readings are based on a test manifold. Flow rates throughout the system may be outside this range.

FACTORS THAT AFFECT MICRO-SPRINKLER AND DRIP SYSTEM EFFICIENCY

Possible problems are checked below:

Maintenance Factors

<input type="checkbox"/>	Clogged filter
<input checked="" type="checkbox"/>	Clogged emitters
<input type="checkbox"/>	Valves not opening
<input type="checkbox"/>	Broken pipes
<input type="checkbox"/>	Pressure regulator malfunction
<input type="checkbox"/>	Mixed Emitters
<input type="checkbox"/>	Other

Design Factors

<input type="checkbox"/>	Low system pressure
<input type="checkbox"/>	Mainline pressure loss
<input checked="" type="checkbox"/>	Different pressure between manifolds
<input type="checkbox"/>	Submain pressure loss
<input type="checkbox"/>	Lateral pressure loss
<input type="checkbox"/>	Elevation effects
<input type="checkbox"/>	Small irrigated area
<input type="checkbox"/>	Poor emitter uniformity
<input type="checkbox"/>	Other

Sheet: "PrintRecommendations"

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	<u>Anywhere, FL xxxxx</u>	Evaluation Date:	<u>08/26/03</u>
Phone:	<u>(xxx) xxx-xxxx</u>	Field Office:	<u>Your Office</u>
County:	<u>Your</u>	Field ID:	<u>North</u>
Field Area (acres):	<u>25</u>	Field No:	<u>1</u>

PROBLEM DESCRIPTIONS AND RECOMMENDATIONS

Different Pressures Between Manifolds - The average pressure varied between the manifolds. Installing valves or using the existing valves to regulate pressure may equalize pressure between the manifolds to make pressure and flow more uniform throughout the system.

Clogged Emitters - Many emitters were clogged, especially at the ends of the lateral lines. Clogging can be reduced by flushing the laterals more often, using self-flushing end caps, or in severe cases, injecting chlorine, with the injection program based on sulfide and iron concentrations.

Sheet: "Sched"

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MICROIRRIGATION EVALUATION Ver 1.1
IRRIGATION SCHEDULING GUIDE FOR MICROIRRIGATION SYSTEMS
(Microsprinklers)

Name:	_____	Your Name
Date:	_____	08/26/03
Field ID:	_____	North
Crop:	_____	Citrus
Number of emitters per tree:	_____	1
Average flow rate per emitter:	_____	14.58 gph
Average flow rate per tree:	_____	14.58 gph
Irrigation area per tree:	_____	132.7 sq ft
Canopy area per tree:	_____	212.5 sq ft
Potential application efficiency:	_____	69 %
Soil water holding capacity:	_____	0.055 in/in
Root zone depth:	_____	24 in

Month	Management Allowed Deficit (%)	Irrigation		Rainfall	
		Operating Time** Hrs:Min	Irrigation Interval Days	Delay Next Irrigation per 1/4 inch of Rainfall Days	Maximum Delay Days
January	30	03:15	5	5	9
February	30	03:15	4	4	6
March	30	03:15	3	3	4
April	30	03:15	2	2	3
May	30	03:15	1	1	2
June	30	03:15	1	1	2
July	50	05:30	2	1	4
August	50	05:30	3	2	4
September	50	05:30	3	2	5
October	50	05:30	4	3	7
November	50	05:30	6	4	10
December	50	05:30	9	5	14

**** Operating time rounded to the nearest 15 minutes.**

This guide was based on field conditions specific to the site. It provides estimated irrigation operating times and irrigation interval for a specified management allowed deficit. The effect of the water table is not included. Irrigation is delayed until the water supplied by the water table is not adequate for the crop. This guide is the beginning step towards irrigation water management (IWM). As you evaluate your crop's response to this irrigation scheduling guide, refinements will need to be made. The most important aspect of IWM is evaluating and monitoring the plant and soil moisture relationship. This can be accomplished by following the method(s) described in your IWM plan. Contact the NRCS for assistance in implementing your IWM plan.

Sheet: "Sched", Continued

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MICROIRRIGATION EVALUATION Ver 1.1
SCHEDULING GUIDE SUPPORTING DATA FOR MICROIRRIGATION SYSTEMS
(Spray Emitters)

Name:	Your Name
Date:	08/26/03
Field ID:	North
Crop:	Citrus
** Net Average flow rate per tree:	10.0 gph

Net average flow rate per tree is computed by multiplying the ratio of the canopy area and irrigated area times the flow rate per tree times the potential application efficiency.

Month	Water Requirement		
	inches/month	inches/day	gal/tree/day
January	1.42	0.05	6.1
February	1.87	0.07	8.8
March	2.79	0.09	11.9
April	3.98	0.13	17.6
May	5.36	0.17	22.9
June	5.40	0.18	23.8
July	5.35	0.17	22.9
August	4.87	0.16	20.8
September	4.32	0.14	19.1
October	3.03	0.10	12.9
November	2.03	0.07	9.0
December	1.51	0.05	6.5

Month	Management Allowed Deficit (Inches)	Irrigation Management Allowed Deficit (Gallons)	Rainfall Management Allowed Deficit (Gallons)
January	0.40	33	52
February	0.40	33	52
March	0.40	33	52
April	0.40	33	52
May	0.40	33	52
June	0.40	33	52
July	0.66	55	87
August	0.66	55	87
September	0.66	55	87
October	0.66	55	87
November	0.66	55	87
December	0.66	55	87